

Missouri Department of Natural Resources  
**Total Maximum Daily Load Information Sheet**

## Dark Creek

### Waterbody Segment at a Glance:

**County:** Randolph  
**Nearby Cities:** Clifton Hill and Huntsville  
**Length of impairment:** 8 miles  
**Pollutant:** Sulfate  
**Source:** Crutchfield Abandoned Mine Land (AML)



State map showing location of watershed

**TMDL Priority Ranking:** TMDL Approved 2004

### Description of the Problem

#### Beneficial uses of Dark Creek

- Livestock and Wildlife Watering
- Protection of Warm Water Aquatic Life
- Protection of Human Health associated with Fish Consumption

#### Use that is impaired

- Protection of Warm Water Aquatic Life

#### Standards that apply

- Sulfate and chloride are linked together in Missouri's Water Quality Standards (WQS). Section (4)(L)1 states that the concentration of chloride plus sulfate in streams with a 7Q10 low flow of less than one (1) cubic foot per second shall not exceed 1,000 milligrams per liter (mg/L or parts per million) for protection of aquatic life.

### Background Information and Water Quality Data

In the past, approximately 1700 acres of land were strip mined for coal near Darksville, in Randolph County, and were later abandoned. This area is called the Crutchfield Abandoned Mine Land (AML). This AML drains into Dark Creek. Sulfide minerals, commonly found in coal and surrounding rock, oxidize when exposed to the air and are subsequently dissolved by surface flows and groundwater. This weathering process results in large amounts of sulfate in surface runoff and shallow groundwaters being discharged to Dark Creek. Freshwater aquatic life cannot tolerate large amounts of dissolved substances in water. The table below shows the results of fifteen water quality surveys of four locations on Dark Creek completed by the Department of Natural Resources from 2000 through 2004. The rate of exceedence of the 1,000 mg/L standard ranges from 56

percent at site 1 to 12.5 percent at site 4. Any exceedence rate of the sulfate plus chloride standard greater than 10 percent is considered to be causing water quality impairment.

### **Data for Dark Creek, Randolph County, Missouri (2000-2004)**

(Key to abbreviations may be found below the table)

| <b>Site #</b> | <b>Site Name</b>                          | <b>Year</b> | <b>Mo</b> | <b>Day</b> | <b>pH</b> | <b>SO4</b>  | <b>CI</b> | <b>SO4+CI</b> | <b>PE</b>  |
|---------------|---|-------------|-----------|------------|-----------|-------------|-----------|---------------|------------|
| 1             | Dark Creek 0.1 mile below Crutchfield AML | 2000        | 3         | 17         | 7.5       | 855         | 41        | 896           |            |
| 1             | Dark Creek 0.1 mile below Crutchfield AML | 2000        | 4         | 24         | 7         | 1710        | 15        | 1725          |            |
| 1             | Dark Creek 0.1 mile below Crutchfield AML | 2000        | 8         | 18         | 8         | 1360        | 19        | 1379          |            |
| 1             | Dark Creek 0.1 mile below Crutchfield AML | 2001        | 3         | 6          | 6.8       | 566         | 17        | 583           |            |
| 1             | Dark Creek 0.1 mile below Crutchfield AML | 2001        | 6         | 14         | 7         | 747         | 17        | 764           |            |
| 1             | Dark Creek 0.1 mile below Crutchfield AML | 2001        | 9         | 4          | 7.2       | 1190        | 14        | 1204          |            |
| 1             | Dark Creek 0.1 mile below Crutchfield AML | 2001        | 10        | 25         | 7.7       | 1240        | 17        | 1257          |            |
| 1             | Dark Creek 0.1 mile below Crutchfield AML | 2001        | 12        | 20         | 7.2       | 1220        | 23        | 1243          |            |
| 1             | Dark Creek 0.1 mile below Crutchfield AML | 2002        | 1         | 10         | 6.8       | 2130        | 14        | 2144          |            |
| 1             | Dark Creek 0.1 mile below Crutchfield AML | 2002        | 3         | 18         | 6.8       | 664         | 19        | 683           |            |
| 1             | Dark Creek 0.1 mile below Crutchfield AML | 2002        | 6         | 28         | 7.6       | 738         | 20        | 758           |            |
| 1             | Dark Creek 0.1 mile below Crutchfield AML | 2002        | 9         | 25         | 7.6       | 2270        | 15        | 2285          |            |
| 1             | Dark Creek 0.1 mile below Crutchfield AML | 2002        | 12        | 10         | 7.8       | 2400        | 13        | 2413          |            |
| 1             | Dark Creek 0.1 mile below Crutchfield AML | 2003        | 3         | 12         | 7.9       | 1710        | 14        | 1724          |            |
| 1             | Dark Creek 0.1 mile below Crutchfield AML | 2004        | 3         | 4          | 7         | 580         | 28        | 608           |            |
| 1             | Dark Creek 0.1 mile below Crutchfield AML | 2004        | 5         | 28         | 7.2       | 96          | 16        | 112           |            |
|               | <b>Mean</b>                               |             |           |            |           | <b>1217</b> | <b>19</b> | <b>1236</b>   | <b>56%</b> |
| 2             | Dark Creek 3 miles below Crutchfield AML  | 2000        | 3         | 17         | 7.4       | 618         | 28        | 646           |            |
| 2             | Dark Creek 3 miles below Crutchfield AML  | 2000        | 4         | 24         | 7.7       | 1550        | 13        | 1563          |            |
| 2             | Dark Creek 3 miles below Crutchfield AML  | 2000        | 8         | 18         | 7.8       | 245         | 14        | 259           |            |
| 2             | Dark Creek 3 miles below Crutchfield AML  | 2001        | 3         | 6          | 7.6       | 465         | 15        | 480           |            |
| 2             | Dark Creek 3 miles below Crutchfield AML  | 2001        | 7         | 14         | 7.6       | 384         | 14        | 398           |            |
| 2             | Dark Creek 3 miles below Crutchfield AML  | 2001        | 9         | 4          | 7.6       | 449         | 21        | 470           |            |
| 2             | Dark Creek 3 miles below Crutchfield AML  | 2001        | 10        | 25         | 7.8       | 529         | 16        | 545           |            |
| 2             | Dark Creek 3 miles below Crutchfield AML  | 2001        | 12        | 20         | 7.8       | 879         | 18        | 897           |            |
| 2             | Dark Creek 3 miles below Crutchfield AML  | 2002        | 1         | 10         | 7.3       | 1460        | 15        | 1475          |            |
| 2             | Dark Creek 3 miles below Crutchfield AML  | 2002        | 3         | 18         | 7.6       | 541         | 15        | 556           |            |
| 2             | Dark Creek 3 miles below Crutchfield AML  | 2002        | 6         | 28         | 7.8       | 866         | 12        | 878           |            |
| 2             | Dark Creek 3 miles below Crutchfield AML  | 2002        | 9         | 25         | 7.8       | 511         | 29        | 540           |            |
| 2             | Dark Creek 3 miles below Crutchfield AML  | 2002        | 12        | 10         | 7.6       | 2600        | 20        | 2620          |            |
| 2             | Dark Creek 3 miles below Crutchfield AML  | 2003        | 3         | 12         | 8         | 1320        | 15        | 1335          |            |
| 2             | Dark Creek 3 miles below Crutchfield AML  | 2004        | 3         | 4          | 7.6       | 544         | 20        | 564           |            |
| 2             | Dark Creek 3 miles below Crutchfield AML  | 2004        | 5         | 28         | 7.5       | 100         | 10        | 110           |            |
|               | <b>Mean</b>                               |             |           |            |           | <b>816</b>  | <b>17</b> | <b>833.5</b>  | <b>25%</b> |
| 3             | Dark Creek 6 miles below Crutchfield AML  | 2000        | 3         | 17         | 7.2       | 1120        | 14        | 1134          |            |
| 3             | Dark Creek 6 miles below Crutchfield AML  | 2000        | 4         | 24         | 7.5       | 1110        | 15        | 1125          |            |
| 3             | Dark Creek 6 miles below Crutchfield AML  | 2000        | 8         | 18         | 8         | 306         | 10        | 316           |            |
| 3             | Dark Creek 6 miles below Crutchfield AML  | 2001        | 3         | 6          | 7.7       | 360         | 12        | 372           |            |
| 3             | Dark Creek 6 miles below Crutchfield AML  | 2001        | 7         | 14         | 7.5       | 299         | 14        | 313           |            |
| 3             | Dark Creek 6 miles below Crutchfield AML  | 2001        | 9         | 4          | 7.5       | 740         | 12        | 752           |            |
| 3             | Dark Creek 6 miles below Crutchfield AML  | 2001        | 10        | 25         | 7.8       | 352         | 11        | 363           |            |
| 3             | Dark Creek 6 miles below Crutchfield AML  | 2001        | 12        | 20         | 7.8       | 856         | 15        | 871           |            |
| 3             | Dark Creek 6 miles below Crutchfield AML  | 2002        | 1         | 10         | 7.4       | 917         | 18        | 935           |            |
| 3             | Dark Creek 6 miles below Crutchfield AML  | 2002        | 3         | 12         | 8.1       | 1110        | 13        | 1123          |            |
| 3             | Dark Creek 6 miles below Crutchfield AML  | 2002        | 3         | 18         | 8         | 488         | 13        | 501           |            |
| 3             | Dark Creek 6 miles below Crutchfield AML  | 2002        | 6         | 28         | 7.9       | 580         | 10        | 590           |            |
| 3             | Dark Creek 6 miles below Crutchfield AML  | 2002        | 9         | 25         | 7.6       | 316         | 10        | 326           |            |

|          |  |      |             |    |     |      |            |           |              |
|----------|--|------|-------------|----|-----|------|------------|-----------|--------------|
| <b>3</b> | Dark Creek 6 miles below Crutchfield AML | 2002 | 12          | 10 | 7.5 | 1060 | 15         | 1075      |              |
| <b>3</b> | Dark Creek 6 miles below Crutchfield AML | 2004 | 3           | 4  | 7.6 | 509  | 17         | 526       |              |
| <b>3</b> | Dark Creek 6 miles below Crutchfield AML | 2004 | 5           | 28 | 7.3 | 143  | 9          | 152       |              |
|          |  |      | <b>Mean</b> |    |     |      | <b>642</b> | <b>13</b> | <b>654.6</b> |
| <b>4</b> | Dark Creek 8 miles below Crutchfield AML | 2000 | 3           | 17 | 7.6 | 1130 | 10         | 1140      |              |
| <b>4</b> | Dark Creek 8 miles below Crutchfield AML | 2000 | 4           | 24 | 7.5 | 1020 | 16         | 1036      |              |
| <b>4</b> | Dark Creek 8 miles below Crutchfield AML | 2000 | 8           | 18 | 8   | 242  | 10         | 252       |              |
| <b>4</b> | Dark Creek 8 miles below Crutchfield AML | 2001 | 3           | 6  | 7.4 | 298  | 13         | 311       |              |
| <b>4</b> | Dark Creek 8 miles below Crutchfield AML | 2001 | 7           | 14 | 7.2 | 274  | 15         | 289       |              |
| <b>4</b> | Dark Creek 8 miles below Crutchfield AML | 2001 | 9           | 4  | 7.4 | 411  | 10         | 421       |              |
| <b>4</b> | Dark Creek 8 miles below Crutchfield AML | 2001 | 10          | 25 | 7.4 | 283  | 16         | 299       |              |
| <b>4</b> | Dark Creek 8 miles below Crutchfield AML | 2001 | 12          | 20 | 7.8 | 721  | 15         | 736       |              |
| <b>4</b> | Dark Creek 8 miles below Crutchfield AML | 2002 | 1           | 10 | 7.3 | 959  | 20         | 979       |              |
| <b>4</b> | Dark Creek 8 miles below Crutchfield AML | 2002 | 3           | 12 | 8.1 | 893  | 14         | 907       |              |
| <b>4</b> | Dark Creek 8 miles below Crutchfield AML | 2002 | 3           | 18 | 7.8 | 425  | 14         | 439       |              |
| <b>4</b> | Dark Creek 8 miles below Crutchfield AML | 2002 | 6           | 28 | 7.5 | 445  | 11         | 456       |              |
| <b>4</b> | Dark Creek 8 miles below Crutchfield AML | 2002 | 9           | 25 | 7.8 | 748  | 29         | 777       |              |
| <b>4</b> | Dark Creek 8 miles below Crutchfield AML | 2002 | 12          | 10 | 7.4 | 841  | 16         | 857       |              |
| <b>4</b> | Dark Creek 8 miles below Crutchfield AML | 2004 | 3           | 4  | 7.5 | 429  | 20         | 449       |              |
| <b>4</b> | Dark Creek 8 miles below Crutchfield AML | 2004 | 5           | 28 | 7.3 | 109  | 9          | 118       |              |
|          |  |      | <b>Mean</b> |    |     |      | <b>517</b> | <b>15</b> | <b>519.6</b> |
|          |  |      |             |    |     |      |            |           | <b>12.5%</b> |

Source: Missouri Department of Natural Resources

AML = Abandoned Mine Land; SO4 = Sulfate in mg/L; Cl = Chloride in mg/L

pH = The measurement of acidity or alkalinity. A pH of 7 Standard Units is neutral; 1-6 is acidic; 8-14 is basic or alkaline.

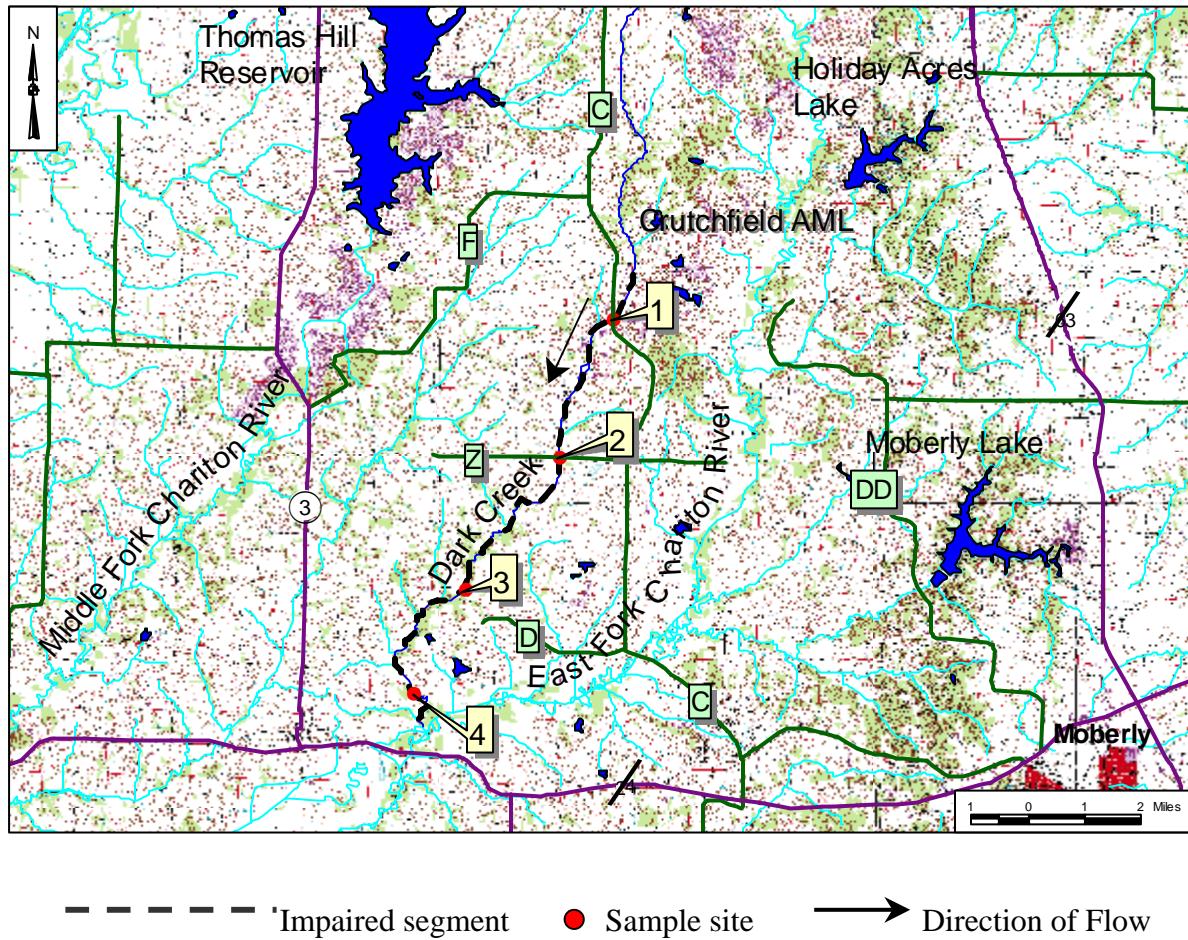
PE = Percent Exceedence, (eg At the site 0.1 mile below the AML site, water quality standards for sulfate and chloride are exceeded 64 percent of the time.)

In 1990, at a cost of \$1,213,004, the department's Land Reclamation Program conducted a reclamation project on the coal waste areas in the Crutchfield AML totaling 162 acres. This project was accomplished mainly by re-contouring the surface of the land, eliminating acid ponds, burying acid-forming spoils and establishing permanent vegetation. The project has remedied the worst of the problems. What remains to be done is to reduce the amount of sulfate and chloride materials being exposed to air and water through soil erosion. Every time soil is removed through erosion on these surface mined lands, new sulfate and chloride materials are exposed to air and water which increases the amount of sulfate-rich runoff that enters Dark Creek.

The way to control the Acid Soil Erosion of previously mined land is to install good farming practices. There is a current Agricultural Nonpoint Source (AgNPS) Special Land Area Treatment (SALT) Project for Dark and Sugar Creeks in Randolph County that is able to funnel resources to the Dark Creek watershed. This seven-year project was initiated July 1, 2002 with a budget of \$750,000. There is a steering committee and many educational activities have already taken place. The July 2004 Semi-annual Progress Report shows that overall the project is 11 percent complete. The department has been working with the Randolph County Soil and Water District through educational meetings with the steering committee and other landowners. The meetings discuss how the AgNPS SALT goals to reduce the soil erosion and increase productivity of the land parallel the goals in the Dark Creek TMDL.

The U.S. Environmental Protection Agency approved the TMDL December 15, 2004. A map of the area and a graph of the data may be found below.

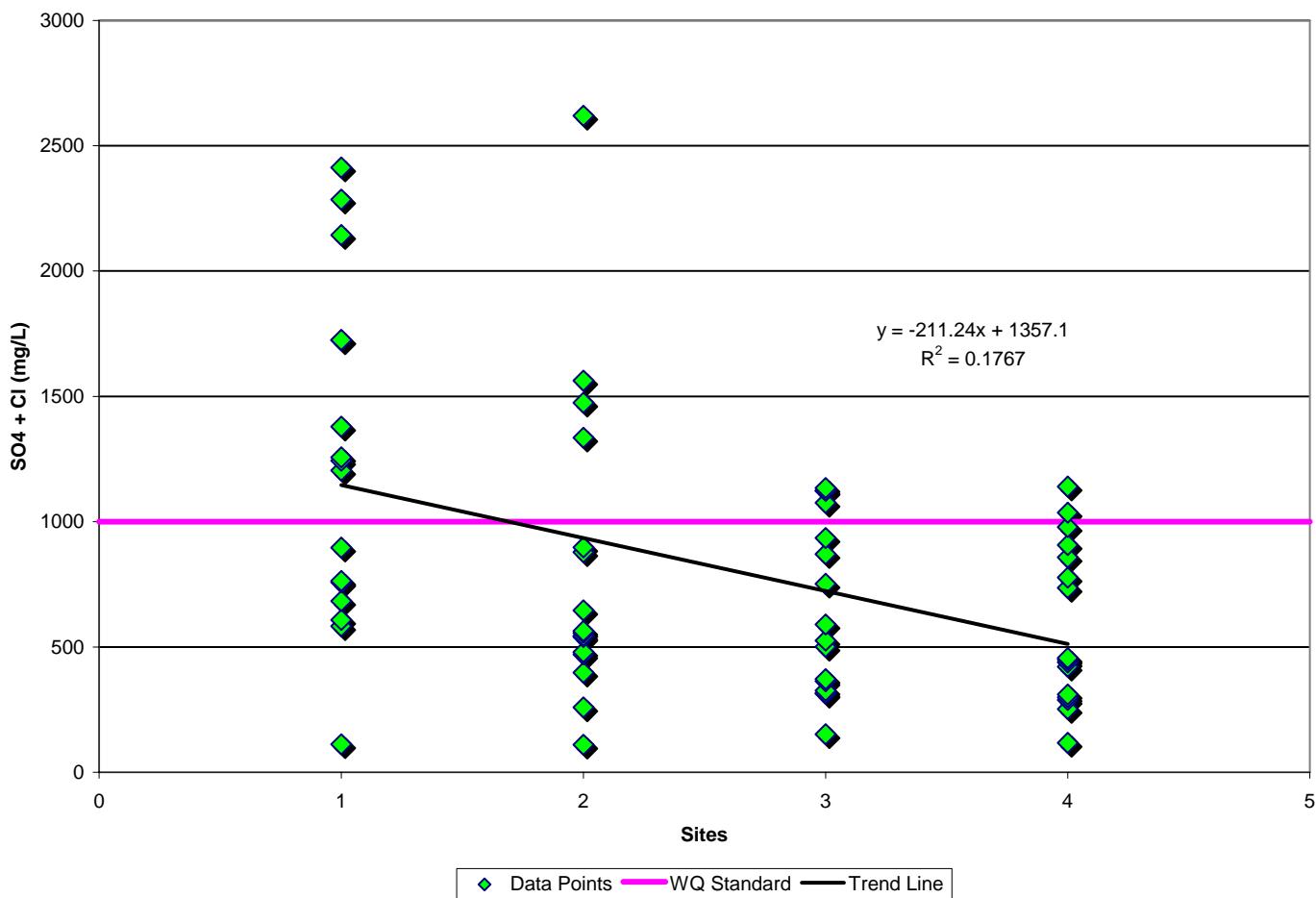
## Dark Creek in Randolph County, Missouri, Showing Sampling Sites and the Impaired Segment



### Site Index

- 1 – Dark Creek 0.1 mile below Crutchfield AML
- 2 – Dark Creek 3 miles below Crutchfield AML
- 3 – Dark Creek 6 miles below Crutchfield AML
- 4 – Dark Creek 8 miles below Crutchfield AML

## Sulfate plus Chloride in Dark Creek 2000-2004 with Trend Line



### For more information call or write:

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